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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/040,378	01/09/2002	Daisuke Komada	107317-00040	5475

7590 11/20/2003

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EXAMINER	
VINH, LAN	

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 11/20/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/040,378	KOMADA, DAISUKE	
	Examiner	Art Unit	
	Lan Vinh	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *9/2/2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2 and 4-15* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-2, 4-15* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☒ Certified copies of the priority documents have been received in Application No. *10/040378* .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 2, 4, 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Donohoe et al. (US 6,635,335) in view of Bhardwaj et al (US 6,051,503)

Donohoe discloses an etching method. This method comprises the steps of:

forming a mask pattern 407 over an dielectric layer 409 (oxide) (col 8, lines 10-12, fig. 4C), which reads on covering a surface of an insulating film made of silicon-containing insulating material with a mask pattern

etching the dielectric layer 409 using mask pattern 407 as a mask and etching gas contains a mixture of C_4F_8 and C_5F_8 (col 10, lines 1-4)

Unlike the instant claimed invention as per claim 1, Donohoe fails to disclose the specific value of the fractional partial pressure of C_4F_8 and C_5F gases is greater than 0 and less than or equal to 0.5.

However, Bhardwaj discloses a method of surface treatment comprises the step of using the fractional partial pressure of the first gas and the second gases of less than 5%/0.5 (col 6, lines 14-15)

Since Donohoe is concerned with a method of etching using the first and second gas, one skilled in the art would have found it obvious to modify Donohoe's etching step by

using the total partial pressure of the first gas and the second gases of less than 5%/0.5 as per Bhardwaj because Bhardwaj states that it will seen that where the fractional partial pressure of the first gas and the second gases of less than 5%, the etching process rate is substantially steady state (col 6, lines 11-16)

The limitations of claims 2, 4 have been discussed above.

Regarding claim 5, Donohoe discloses using noble gas in the etching step (col 10, lines 2-3)

3. Claim 6 rejected under 35 U.S.C. 103(a) as being unpatentable over Donohoe et al. (US 6,635,335) in view of Bhardwaj et al (US 6,051,503) and further in view of Hung et al (US 6,380,096)

Donohoe as modified by Bhardwaj has been described above. Unlike the instant claimed invention as per claim 6, Donohoe and Bhardwaj fail to disclose the step of forming an etching stopper film (SiN) on the surface of a semiconductor substrate and under the oxide layer.

Hung discloses a oxide etch comprises the step of forming etching stopper film (SiN) 12 on the surface of a semiconductor substrate and under the oxide layer (col 5, lines 22-25)

Hence, one skilled in the art would have found it obvious to modify Donohoe and Bhardwaj by adding the step of forming an etching stopper film (SiN) on the surface of a semiconductor substrate and under the oxide layer as per Hung because according to

Hung forming an etching stopper layer allows tighter control on where the different steps begin and end (col 5, lines 46-52)

4. Claims 7, 8, 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hung et al. (US 6,380,096) in view of Donohoe et al. (US 6,635,335)

Hung discloses an in situ oxide etch process particularly useful for a counterbore dual-damascene structure. This process comprises the steps of:

forming a semiconductor substrate 10 having a metal wiring 11 having upper surface exposed on a surface of the substrate 10 (col 9, lines 48-49 , fig. 9)

forming an etch stop layer 12 made of silicon nitride on the surface of the substrate 10 (col 2, lines 24-37)

depositing a dielectric layer 14 (silicon oxide) on the layer 12/etching stopper film, the etch nitride, the etch selectivity etches the dielectric layer over the stop material (col 2, lines 19-25), which reads on depositing an insulating film on the etching stopper film, the insulating film being made of a second insulating material which contains si and ahs an etching resistance different from the etching stopper film

forming a resist pattern 98 over an dielectric layer 14 (silicon oxide), the resist pattern having an opening aligned over the metal wiring 11 (col 9, lines 1-9, fig. 5), which reads on covering a surface of an insulating film made of silicon-containing insulating material with a resist pattern having an opening superposed upon the metal wiring

etching the dielectric layer 14 using the mask pattern 98 as a mask and etching gas contains C_4F_8 and another fluorocarbon gas to form an opening/recess exposing the etching stopper film 12 at the bottom of the opening/recess (col 5, lines 30-50, fig. 6)

removing the resist pattern 98 /118 while the wiring 11 is covered by the etching stopper layer 12 (col 9, lines 30-32, fig.8 and fig. 9), which reads on removing the resist pattern under a condition that the metal wiring is covered with the etching stopper film

removing the exposed etching stop layer 12 to expose the metal wiring 11 (fig. 9)

filling/burying copper/conductive material in the opening/recess etched in the dielectric layer to form interconnect/conductive member contacting the metal wiring 11 (col 9, lines 45-49), the etch chemistry is available which etches the dielectric layer/second insulating material 14 but stops on the stop layer 12/first insulating layer (col 2, lines 21-24), which reads on the etching rate of the first insulating material is slower than an etching rate of the second insulating material when the dry-etching step is performed by the etching gas.

Unlike the instant claimed invention as per claim 7, Hung fails to disclose using an etching gas contains C_4F_8 and C_xF_y gas to form a recess/opening (wherein x is greater than or equal to 5 and y is less than or equal to (2x-1)

Donohoe discloses an etching method comprises the steps of:etching the dielectric layer (oxide) 409 using etching gas contains a mixture of C_4F_8 and C_5F_8 (col 10, lines 1-5)

Since both Hung and Donohoe are concerned with method of etching oxide layer one skilled in the art would have found it obvious to employ Donohoe's etching mixture in

Hung' s oxide etching step because Donohoe states that an oxide coated substrate is etched in a plasma generated with suitable gases includes a mixture of C_4F_8 and C_5F_8 (col 9, lines 65-67; col 10, lines 1-2)

The limitation of claim 8 has been discussed above.

Regarding claim 10, Hung discloses that the dielectric/insulating film 14 is made of silicon dioxide or borophosphosilicate glass (col 2, lines 30-33)

5. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hung et al. (US 6,380,096) in view of Donohoe et al. (US 6,635,335) and further in view of Bhardwaj et al (US 6,051,503)

Hung as modified by Donohoe has been described above. Unlike the instant claimed invention as per claim 9, Hung and Donohoe fail to disclose the specific value of the fractional partial pressure of C_4F_8 and C_5F gases is greater than 0 and less than or equal to 0.5.

However, Bhardwaj discloses a method of surface treatment comprises the step of using the fractional partial pressure of the first gas and the second gases of less than 5%/0.5 (col 6, lines 14-15)

Since Hung and Donohoe is concerned with a method of etching using the first and second gas, one skilled in the art would have found it obvious to modify Hung and Donohoe by using the total partial pressure of the first gas and the second gases of less than 5%/0.5 as per Bhardwaj because Bhardwaj states that it will seen that where the

fractional partial pressure of the first gas and the second gases of less than 5%, the etching process rate is substantially steady state (col 6, lines 11-16)

6. Claims 11, 12, 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hung et al. (US 6,380,096) in view of Donohoe et al. (US 6,635,335)

Hung discloses an in situ oxide etch process particularly useful for a counterbore dual-damascene structure. This process comprises the steps of:

forming an etch stop layer 12/first film made of SiN on the underlying layer 10 with a copper wiring 11 (col 2, lines 16-18; fig. 5)

depositing a dielectric layer 14 (silicon oxide)/second film on the layer 12/first film (col 2, lines 19-25)

etching the dielectric layer 14 using the mask pattern 98 as a mask and etching gas contains C_4F_8 and another fluorocarbon gas (col 5, lines 30-50, fig. 6)

Unlike the instant claimed invention as per claim 11, Hung fails to disclose using an etching gas contains C_4F_8 and C_xF_y (wherein x is greater than or equal to 5 and y is less than or equal to (2x-1)

Donohoe discloses an etching method comprises the steps of: etching the dielectric layer (oxide) 409 using etching gas contains a mixture of C_4F_8 and C_5F_8 (col 10, lines 1-5)

Since both Hung and Donohoe are concerned with method of etching oxide layer one skilled in the art would have found it obvious to employ Donohoe's etching mixture in Hung' s oxide etching step because Donohoe states that an oxide coated substrate is

etched in a plasma generated with suitable gases includes a mixture of C_4F_8 and C_5F_8 (col 9, lines 65-67; col 10, lines 1-2)

The limitations of claims 12, 14 have been discussed above.

Regarding claim 15, Hung discloses using argon gas in the etching step (col 5, table 2)

7. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hung et al. (US 6,380,096) in view of Donohoe et al. (US 6,635,335) and further in view of Bhardwaj et al (US 6,051,503)

Hung as modified by Donohoe has been described above. Unlike the instant claimed invention as per claim 13, Hung and Donohoe fail to disclose the specific value of the fractional partial pressure of C_4F_8 and C_5F gases is greater than 0 and less than or equal to 0.5.

However, Bhardwaj discloses a method of surface treatment comprises the step of using the fractional partial pressure of the first gas and the second gases of less than 5%/0.5 (col 6, lines 14-15)

Since Hung and Donohoe is concerned with a method of etching using the first and second gas, one skilled in the art would have found it obvious to modify Hung and Donohoe by using the total partial pressure of the first gas and the second gases of less than 5%/0.5 as per Bhardwaj because Bhardwaj states that it will seen that where the fractional partial pressure of the first gas and the second gases of less than 5%, the etching process rate is substantially steady state (col 6, lines 11-16)

Response to Arguments

8. Applicant's arguments with respect to claims 1-15 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is 703 305-6302. The examiner can normally be reached on M-F 8:30-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 703 305-2667. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872-9310 for regular communications and 703 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308-0661.

LV
November 13, 2003